

## WHAT IS CLAIMED IS:

1. A network configuration data management system comprising:

(a) storage means for providing storage management facilities, said storage means storing:

5 a current map for containing information represented as a current network configuration information, and

10 a temporary map for containing information for the network components for which the configuration changes are expected to occur at any future time and/or information for network components for which the configuration changes occurred at any past time; and

15 (b) means for generating network configuration information that is applicable to any time relative to a particular time later than the current time and/or relative to a particular time earlier than the current time, based on the information in said current map and the information in said temporary map.

2. A network configuration data management system comprising:

(a) a directory server storing:

5 a current map tree for containing current network configuration information organized into a tree structure, and a temporary map tree for only containing information for network components organized into a tree structure and for which configuration changes are expected to occur at any future time;

(b) means responsive to a request for a network  
 10 configuration information applicable to any future time from an  
 external requester, for issuing a request to access said current  
 map tree and said temporary map tree stored in said directory  
 server in order to search for appropriate trees containing  
 directory entries, and obtaining the appropriate configuration  
 15 information as requested by the requester; and

(c) means for merging the configuration information  
 obtained from said current map tree together with the  
 configuration information obtained from said temporary tree,  
 generating a network configuration information applicable to  
 20 the time specified by the requester, and returning the generated  
 network configuration information to the requester.

3. A network configuration data management system comprising:

(a) a directory server including:

(a1) a current map tree for containing information  
 for current network configuration conditions organized into a  
 5 directory tree format, and

(a2) a temporary map tree for containing  
 differential information for a future network configuration  
 organized into a directory tree structure that represents a  
 difference resulting from any changes made to the current  
 10 network configuration; and

(b) a network configuration information management  
 apparatus including:

(b1) network configuration data control means that responds to a request from any external application for  
15 providing network configuration data management functions by performing operations on the map data.

(b2) current map tree access means for accessing said current map tree within said directory server to retrieve appropriate information therefrom, and updating the retrieved  
20 information, and

(b3) temporary map tree access means for accessing said temporary map tree within said directory server to perform generating, modifying and deleting operations, wherein

a future network configuration information that  
25 represents the information expected to occur at any future time later than the current time may be generated by merging the information in said current map tree together with the information in said temporary map tree.

4. The network configuration data management system as defined in Claim 2, wherein the requirements for storing the network configuration information may be reduced by storing, in said temporary map tree, the differential information that  
5 represents the difference from the current network configuration information, and the network configuration information may be obtained from said temporary map tree.

5. The network configuration data management system as defined in Claim 3, wherein said network configuration information

management apparatus includes a network configuration data store section for storing the directory tree information temporarily.

6. The network configuration data management system as defined in Claim 5, wherein said network configuration information control means is configured for;

accessing said current map tree containing the current network configuration information through said current map tree access means, and retrieving the information for the component as identified by an entry located under the current map entry from said current map tree;

temporarily storing the information thus retrieved in said network configuration data store section;

accessing said temporary map tree through said temporary map tree access means, and searching said temporary map tree for any temporary map entry information applicable to the time earlier than the time specified by said external application; wherein

if it is found that no such temporary map entry is available, meaning that the information retrieved from the current map entry is determined to be the search result, returning the current map entry information to said external application as it remains unchanged, and if it is found that one or more such temporary map entries are available, collects every entry information located under the temporary map entry and

specified by said external application that has been retrieved  
from said temporary map tree through said temporary map tree  
25 access means, and

wherein said network configuration data control means is  
further configured for;

merging the entry information under the temporary map  
entry and collected together with the current map tree  
30 previously stored in said network configuration data store  
means; and

collecting all temporary map entries and merges them to  
update the entry information under the current map entry and  
stored in said network configuration data store means, and  
35 returning the updated version of the information to said  
external application.

7. The network configuration data management system as defined  
in Claim 3, wherein

said directory server includes a log map tree for storing  
the log information that occurred in the past for a particular  
5 component; and

said network configuration information management  
apparatus includes log map tree access means that allows said  
apparatus to access the log map tree, and

wherein

10 if the network configuration information that may be  
applicable to any past time is requested, said network

configuration data control means responds to that request for causing said map tree access means and said log map tree access means to accessing said current map tree and said log map tree within said directory server, respectively, and retrieve the information from the respective map trees, and for obtaining the past network configuration information by merging the information retrieved from the current map tree together with the log map information that has been setup up to said any past time.

8. A network configuration data management method comprising the steps of:

storing and managing, in a store section, a current map containing current network configuration information organized into a hierarchical structure and a temporary map containing the information for components for which configuration changes are expected to occur in the future; and

merging the information in the current map together with the information in the temporary map to generate a future network configuration information that represents an information applicable to a particular time later than the current time.

9. A network configuration data management method comprising the steps of:

(a) storing in a directory server:

a current map tree for containing network configuration information organized into a tree structure, and

a temporary map tree for only containing information for those network components for which configuration changes are expected to occur at any future time later than the current time;

(b) merging the current map tree together with the  
 10 temporary map tree that contains information applicable to any particular future time, to generate a future network configuration information;

(c) in response to a request for the network configuration information applicable to any future time from a requester,  
 15 issuing a request to access the current map tree and temporary map tree stored in said directory server for searching for the trees containing the directory entries, and retrieving the network configuration information as requested;

(d) merging the configuration retrieved from said current  
 20 map tree together with the configuration information retrieved from said temporary map tree to generate a network configuration information applicable to said particular future time; and

(e) returning the generated network configuration information to the requester.

10. In a system comprising a network configuration information management apparatus, the network configuration information management apparatus including:

(a) a directory server for storing a current map tree that  
 5 contains information for current network configuration conditions organized into a directory tree structure and a

temporary map tree that contains future configuration information, organized into a directory tree structure, that represents a difference from the current network configuration  
10 resulting from any changes made to the current network configuration;

(b) network configuration data control means for providing the network configuration data management functions by performing operations on the map data in response to a request  
15 from any external application;

(c) current map tree access means for accessing the current map tree stored in said directory server to retrieve the information therefrom, and updating the retrieved information;  
and

20 (d) a temporary map tree access means for accessing the temporary map tree stored in said directory server, and generating, modifying and updating the information therein, a network configuration data management method comprising the steps of:

25 (A1) receiving, at said network configuration data control means, a request for modifying configuration data from any external application, said network configuration data control means responding to the request to request that the temporary map tree access means generate a temporary map entry  
30 as a root for the temporary map tree, and said temporary map tree access means responding to the request from said network

configuration data control means to access said directory server for generating the temporary map entry;

(A2) sorting data instructed in the request, termed as  
 35 "request data", for modifying the configuration data for each entry, in the order of the directory tree hierarchy beginning with a top level toward a bottom level;

(A3) retrieving said sorted data in the request sequentially, and checking them to determine whether what is  
 40 requested is to add, modify, or delete an entry;

(A4) dividing the processing steps into add, modify and delete, based on the results of the checking,

(A5) if it is determined that an entry is to be added, generating an entry designated as Add in the temporary map tree;

45 (A6) if it is determined that any existing entry is to be modified, generating an entry designated as Modify in the temporary map tree; and

(A7) if it is determined that the information for any existing entry is to be deleted, generating an entry designated  
 50 as Delete in the temporary map tree.

11. The network configuration data management method as defined in Claim 10, wherein the step of generating an entry designated as Add in the temporary map tree includes the steps of:

55 (B1) extracting an appropriate identifier identifying the location of entry in said directory tree from an identifier

contained in the retrieved request data;

(B2) based on the extracted identifier, checking whether a parent entry for the entry designated as Add already exists  
60 in said temporary map tree;

(B3) if it is determined that the parent entry does not exist, causing said network configuration data control means to access said directory server through said current map tree access means and retrieve a parent entry information that  
65 resides in said current map tree stored in said directory server;

(B4) generating a parent entry under the temporary map entry through said temporary map tree access means, wherein as the parent entry exists in said current map tree, requiring no modification, when said temporary map tree is merged together  
70 with said current map tree, said temporary map tree access means bypasses the generating step, setting a value for the type of operation that is one attribute of the parent entry in the directory class under the map to "Not Applicable (N/A)"; and

(B5) generating the entry designated as Add in the request,  
75 and adding the entry under the parent entry generated through said temporary map tree access means, wherein when said temporary map tree is merged together with said current map tree, the attribute value for the operation type in the directory class under the tree is set to "Add" to indicate that said new entry  
80 should be added in said current map tree.

12. The network configuration data management method as defined

in Claim 10, wherein the step of generating an entry designated as Modify in the temporary map tree includes the steps of:

(C1) retrieving the appropriate identifier identifying  
5 the location of entry in said directory tree from identifiers  
contained in the retrieved request data;

(C2) based on the retrieved identifier, checking whether  
the parent entry for the entry designated as Modify already  
exists in said temporary map tree;

10 (C3) if it is determined that the parent entry does not  
exist, causing said network configuration data control means to  
access said directory server through said current map tree  
access means and retrieve the parent entry information that  
resides in said current map tree stored in said directory server;

15 (C4) generating a parent entry under the temporary map  
entry through said temporary map tree access means, wherein as  
the parent entry exists in said current map tree, requiring no  
modification, at the time when said temporary map tree is merged  
together with said current map tree, said temporary map tree  
20 access means bypasses the generating step, setting a value for  
the operation type that is one attribute of the parent entry in  
the directory class under the map to "Not Applicable (N/A)"; and

(C5) generating an entry designated as Modify in the  
request data, and adding the entry under the parent entry  
25 generated through said temporary map tree access means, wherein  
when said temporary map tree is merged together with said current

map tree, the attribute value for the operation type in the directory class under the map tree is set to "Modify" to indicate that said existing entry should be modified in said current map tree.

13. The network configuration data management method as defined in Claim 10, wherein the step of generating an entry designated as Delete in the temporary map tree includes the steps of:

(D1) retrieving the appropriate identifier identifying the location of entry in said directory tree from the identifiers contained in the retrieved request data;

(D2) based on the retrieved identifier, checking whether the parent entry for the entry designated as Delete already exists in said temporary map tree;

(D3) if it is determined that the parent entry does not exist, causing said network configuration data control means to access said directory server through said current map tree access means and retrieve the parent entry information that resides in said current map tree stored in said directory server;

(D4) generating a parent entry under the temporary map entry through said temporary map tree access means, wherein as the parent entry exists in said current map tree, requiring no modification, at the time when said temporary map tree is merged together with said current map tree, said temporary map tree access means bypasses the generating step, setting the value for the operation type that is one attribute of the parent entry in

the directory class under the map to "Not Applicable (N/A)"; and

(B5) generating the entry designated as Modify as requested, and adding the entry under the parent entry generated through said temporary map tree access means, wherein when said temporary map tree is merged together with said current map tree, the attribute value for the operation class in the directory class under the tree is set to "Delete" to indicate that said existing entry should be deleted in said current map tree.

14. The network configuration data management method as defined in Claim 10, further including the step of updating the current map tree stored in said directory server to a new version by merging said current map tree and said temporary map tree, and wherein said network configuration data control means performs the steps of:

(E1) collecting, through said temporary map tree access means, information for those ones of the entries located under temporary map tree being merged, and that are designated as Delete, Modify or Add;

(E2) determining how many entries have been collected, wherein if it is determined that the number of entries collected is equal to zero, the process is ended, and if it is determined that the number of entries collected is equal to one or more,

(E3) deleting, through said current map tree access means, the entry or entries designated as Delete from the current map tree;

(E4) modifying, through said current map tree access means, the entry or entries designated as Modify in said current map tree;

(E5) adding, through said current map tree access means, the entry or entries designated as Add to the current map tree; and

(E6) when the merge processing for all of the entries designated as Delete, Modify and Add under the temporary map tree has been completed, writing the completion time into the appropriate temporary map entry through said temporary map tree access means.

15. The network configuration data management method as defined in Claim 14, wherein when it is determined that one or more entries located under the temporary map tree are to be deleted, the step (E3) further including causing said network configuration data control means to perform the steps of:

extracting the identifier for the appropriate entry from the information for the entry designated as Delete under the temporary map tree and collected through said temporary map tree access means;

translating the extracted identifier into an identifier for the corresponding entry designated as Delete under the current map tree;

deleting, through said current map tree access means, the entry under the current map tree by using the translated

15 identifier as a parameter; and

repeating the preceding steps until there are no more entries that are to be deleted.

16. The network configuration data management method as defined in Claim 14, wherein when it is determined that one or more entries located under the temporary map tree are to be modified, the step (E4) further including causing said network

5 configuration data control means to perform the steps of:

extracting an identifier for the appropriate entry from the information for the entry designated as Modify under the temporary map tree and collected through said temporary map tree access means;

10 translating the extracted identifier into an identifier for the corresponding entry designated as Modify under the current map tree;

generating a parameter that specifies that the entry is to be modified;

15 modifying, through said current map tree access means, the entry located under the current map tree by using the translated identifier as a parameter; and

repeating the preceding steps until there are no more entries that are to be modified.

17. The network configuration data management method as defined in Claim 14, wherein when it is determined that one or more entries located under the temporary map tree are to be added,

the step (E5) further including causing said network

5 configuration data control means to perform the steps of:

extracting the identifier for the appropriate entry from the information for the entry designated as Add under the temporary map tree and collected through said temporary map tree access means;

10 translating the extracted identifier into an identifier for a corresponding entry designated as Add under the current map tree;

generating a parameter that specifies that the entry is to be added;

15 adding, through said current map tree access means, the entry under the current map tree by using the translated identifier as a parameter; and

repeating the preceding steps until there are no more entries that are to be added.

18. The network configuration data management method as defined in Claim 10, wherein said network configuration information management apparatus further includes a network configuration data store section for storing the directory tree information temporarily, and wherein the method further includes a step of

5 causing said network configuration data control means to perform the steps of:

retrieving, through said current map tree access means, information for a component as specified by the entry under the

10    current map tree and containing the current network  
configuration information;

        storing the retrieved information for said network  
configuration data store section temporarily;

        searching for information for appropriate entries under  
15    the current map tree applicable to any particular time earlier  
than a time specified by said external application;

        if it is determined that the number of temporary map  
entries collected is equal to zero, which means that the  
information obtained from the entries under the current map tree  
20    may be used, returning that information to said external  
application as it remains unchanged;

        if it is determined that the number of temporary map  
entries collected is equal to one or more, collecting the  
information for each of the entries under the temporary map tree  
25    as specified by said external application and retrieved through  
said temporary map tree access means;

        merging the collected entry information under the  
temporary map tree together with the current map tree previously  
stored in said network configuration data store section;

30    merging all of the temporary map entries collected to  
update the information under the current map tree stored in the  
network configuration data store section; and

        returning the updated information to said external  
application.

19. The network configuration data management method as defined in Claim 10, wherein

said directory server further includes a log map tree for storing log information for components that occurred in the past; and

said network configuration data management apparatus further includes a log map tree access means through which it has access to said log map tree, and wherein

in response to the request for the network configuration information that is applicable to any particular time in the past, said network configuration data control means obtains the information in the current map tree stored in said directory server as well as the information in said log map tree, through said current map tree access means and said log map tree access means, respectively, and then produces a new version of the network configuration information as requested by merging the information in said map tree together with the information in said log map tree that has been setup up to said particular past time.

20. The network configuration data management method as defined in Claim 19, wherein if there are one or more entries under the temporary map tree that are to be deleted at the time when the entries under the current map tree are being deleted, the method further includes the step of causing said network configuration data control means to perform the steps of:

extracting an identifier for an appropriate entry from the information for the entry designated as Delete under the temporary map tree and collected through said temporary map tree access means;

translating the retrieved entry identifier into an identifier for the corresponding entry designated as Delete under the current map tree;

generating an entry designated as Added under the log map through said log map tree access means;

deleting the entry under the current map tree through said current map tree access means by using the translated identifier as a parameter; and

repeating the preceding steps until there are no more entries that are to be deleted.

21. The network configuration data management method as defined in Claim 19, wherein if there are one or more entries under the temporary map tree that are to be modified at the time when the entries under the current map tree are being modified, the method further includes a step of causing said network configuration data control means to perform the steps of:

extracting an identifier for an appropriate entry from the information for entry designated as Modify under the temporary map tree and collected through said temporary map tree access means;

translating the retrieved entry identifier into an

identifier for a corresponding entry designated as Modify under the current map tree;

generating a parameter that specifies that the entry is  
15 to be modified;

generating an entry designated as Modify under the log map through said log map tree access means;

modifying the entry under the current map tree through said current map tree access means by using the translated  
20 identifier as a parameter; and

repeating the preceding steps until there are no more entries that are to be modified.

22. The network configuration data management method as defined in Claim 19, wherein if there are one or more entries under the temporary map tree that are to be added at the time when the entries under the current map tree are being added, the method  
5 further includes the step of causing said network configuration data control means to perform the steps of:

extracting the identifier for the appropriate entry from the information for the entry designated as Add under the temporary map tree and collected through said temporary map tree  
10 access means;

translating the extracted identifier into an identifier for a corresponding entry designated as Add under the current map tree;

generating a parameter that specifies that the entry is

15 to be added;

generating an entry designated as Add under the log map through said log map tree access means;

modifying the entry under the current map tree through said current map tree access means by using the translated  
20 identifier as a parameter; and

repeating the preceding steps until there are no more entries that are to be added.

23. The network configuration data management method as defined in Claim 21, further including the step of causing said network configuration data control means to perform the steps of:

retrieving, through said current map tree access means,  
5 the information or attribute value for the entry designated as Add or Modify from the corresponding entry in said current map tree;

extracting the identifier for the appropriate entry from the retrieved information, and translating the extracted  
10 identifier into the corresponding identifier under the log map tree;

checking a value for the type of operation;

if it is determined that the type of operation is "delete", setting the parameter for the entry designated as Add under the  
15 log map tree to specify "add" as the type of operation;

if it is determined that the type of operation is "modify", setting the type of operation for the entry being generated under

the log map tree to "modify";

generating a parameter that specifies that an entry is  
 20 to be generated under the log map tree, based on the attribute  
 value collected from the entry under the current map tree; and

generating the entry in said log map tree within said  
 directory server through said log map tree access means.

24. The network configuration data management method as defined  
 in Claim 21, further including a step of causing said network  
 configuration data control means to perform the steps of:

extracting an identifier from the information obtained  
 5 from the entry designated as Add under the temporary map tree;

translating the extracted identifier into a corresponding  
 identifier for use in generating an entry designated as Delete  
 under the log map tree;

setting the parameter for the entry being generated under  
 10 the log map tree to specify "delete" as the type of operation;  
 and

generating an entry designated as Delete under said log  
 map tree through said log map tree access means.

25. A computer program for being executed on a computer including  
 a network configuration information management apparatus that  
 comprises:

a directory server storing:

5 a current map tree that contains information for the  
 current network condition organized into a directory tree

structure, and

10 a temporary map tree that contains information for the future network configuration, organized into a directory tree structure, that represents a difference from a current network configuration resulting from changes made to the current network configuration;

15 a network configuration data control means responsive to a request received from any external application for performing operations on the map data and providing network configuration data management functions;

a current map tree access means for retrieving and updating the information from the current map tree stored in said directory server; and

20 a temporary map tree access means for performing the generating, modifying, and deleting operations for the temporary map tree stored in said directory server, the functional and processing features of said network configuration data control means,

25 said computer program comprising the steps of:

(A1) receiving a request for change in the configuration from an external application, and requesting that the temporary map tree access means access said directory server to generate a temporary map entry as a root of the temporary map tree;

30 (A2) sorting the data instructed in the configuration change request, in the order of the directory tree hierarchy

beginning with a top level toward a bottom level;

(A3) retrieving the sorted data in the request sequentially, and determining from the retrieved data that it  
 35 requests that an entry is to be added, modified, or deleted;

(A4) based on the result determined in step (A3), dividing the processing steps into Add, Modify and Delete, otherwise treating the request as an error;

40 (A5) if it is determined that Add is requested, generating an entry designated as Add in the temporary map tree;

(A6) if it is determined that Modify is requested, generating an entry designated as Modify in the temporary map tree; and

45 (A7) if it is determined that Delete is requested, generating an entry designated as Delete in the temporary map tree.

26. The computer program as defined in Claim 25, wherein

the step of generating an entry designated as Add in the temporary map tree includes the steps of:

5 (B1) extracting an identifier that indicates the location of entry in said directory tree from the identifier contained in the retrieved data;

(B2) checking the retrieved identifier to determine whether a parent entry for the entry designated as Add in said temporary map tree has already been generated;

10 (B3) if it is determined that the parent entry has not

already been generated, causing said network configuration data control means to retrieve, through said current map tree access means, the parent entry information contained in said current map tree;

15 (B4) generating a parent entry under the temporary map entry through said temporary map tree access means, wherein as the parent entry already exists in said current map tree, requiring no modification, said temporary map tree access means sets the attribute value for the type of operation for the parent  
20 entry in the directory class under the map to "Not Applicable" to indicate that the adding process should be bypassed when said temporary map tree is merged together with said current map tree; and

(B5) generating an additional entry designated as Add and  
25 contained in the data in the request, under the parent entry generated through said temporary map tree access means, wherein said temporary map tree access means sets an attribute value for the type of operation in the directory class under the map to "Add" to indicate that the appropriate additional entry is to  
30 be added in the current map tree when said temporary map tree is merged together with said current map tree.

27. The computer program as defined in Claim 25, wherein

the step of generating an entry designated as Modify in the temporary map tree includes the steps of:

(C1) extracting an identifier that indicates the location

5 of entry in said directory tree from identifiers contained in the retrieved request data;

(C2) checking the extracted identifier to determine whether a parent entry for the entry designated as Add in said temporary map tree has already been generated;

10 (C3) if it is determined that the parent entry has not already been generated, causing said network configuration data control means to retrieve, through said current map tree access means, the parent entry information contained in said current map tree;

15 (C4) generating a parent entry under the temporary map entry through said temporary map tree access means, wherein as the parent entry already exists in said current map tree, requiring no modification, said temporary map tree access means sets an attribute value for the type of operation for the parent entry in the directory class under the map to "Not Applicable"  
20 to indicate that the modifying process should be bypassed when said temporary map tree is merged together with said current map tree; and

(C5) generating an entry designated as Modify and  
25 contained in the data in the request, under the parent entry generated through said temporary map tree access means, wherein said temporary map tree access means sets the attribute value for the type of operation in the directory class under the map tree to "Modify" to indicate that an appropriate entry located

30 in the current map tree is to be modified when said temporary  
map tree is merged together with said current map tree.

28. The program code as defined in Claim 25, wherein

the step of generating an entry designated as Delete in  
the temporary map tree includes the steps of:

5 (D1) extracting an identifier that indicates the location  
of entry in said directory tree from the identifiers contained  
in the retrieved request data;

(D2) checking the extracted identifier to determine  
whether the parent entry for the entry designated as Delete in  
said temporary map tree has already been generated;

10 (D3) if it is determined that the parent entry has not  
already been generated, causing said network configuration data  
control means to retrieve, through said current map tree access  
means, the parent entry information contained in said current  
map tree;

15 (D4) generating a parent entry under the temporary map  
entry through said temporary map tree access means, wherein as  
the parent entry already exists in said current map tree,  
requiring no modification, said temporary map tree access means  
sets the attribute value for the type of operation for the parent  
20 entry in the directory class under the map to "Not Applicable"  
to indicate that the deleting process should be bypassed when  
said temporary map tree is merged together with said current map  
tree; and

(D5) generating an entry designated as Delete and  
25 contained in the data in the request, under the parent entry  
generated through said temporary map tree access means, wherein  
said temporary map tree access means sets an attribute value for  
the type of operation in the directory class under the map to  
"Delete" to indicate that the appropriate entry located in the  
30 current map tree is to be deleted when said temporary map tree  
is merged with said current map tree.

29. The computer program as defined in Claim 25, wherein further  
including the step of updating the current map tree stored in  
said directory server to a new version by merging said current  
map tree and said temporary map tree, and wherein said network  
5 configuration data control means performs the steps of:

(E1) collecting, through said temporary map tree access  
means, information for those ones of the entries located under  
temporary map tree being merged, and that are designated as  
Delete, Modify or Add;

10 (E2) determining how many entries have been collected,  
wherein if it is determined that the number of entries collected  
is equal to zero, the process is ended, and if it is determined  
that the number of entries collected is equal to one or more,

(E3) deleting, through said current map tree access means,  
15 the entry designated as Delete from the current map tree;

(E4) modifying, through said current map tree access means,  
the entry designated as Modify in said current map tree;

(E5) adding, through said current map tree access means, the entry designated as Add to the current map tree; and

20 (E6) when the merge processing for all of the entries designated as Delete, Modify and Add under the temporary map tree has been completed, writing the completion time into the appropriate temporary map entry through said temporary map tree access means.

30. The computer program as defined in Claim 25, wherein when it is determined that there are one or more entries located under the temporary map tree that are to be deleted, the step (E3) further including causing said network configuration data  
5 control means to perform the steps of:

extracting the identifier for the appropriate entry from the information for the entry designated as Delete under the temporary map tree and collected through said temporary map tree access means;

10 translating the extracted identifier into an identifier for the corresponding entry designated as Delete under the current map tree;

deleting, through said current map tree access means, the entry under the current map tree by using the translated  
15 identifier as a parameter; and

repeating the preceding steps until there are no more entries that are to be deleted.

31. The computer program for being executed on a computer as

defined in Claim 25, wherein when it is determined that there are one or more entries located under the temporary map tree that are to be modified, the step (E4) further including causing said network configuration data control means to perform the steps of:

extracting an identifier for the appropriate entry from the information for the entry designated as Modify under the temporary map tree and collected through said temporary map tree access means;

translating the retrieved identifier into an identifier for the corresponding entry designated as Modify under the current map tree;

generating a parameter that specifies that the entry is to be modified;

modifying, through said current map tree access means, the entry under the current map tree by using the translated identifier as a parameter; and

repeating the preceding steps until there are no more entries that are to be modified.

32. The computer program as defined in Claim 25, wherein when it is determined that one or more entries located under the temporary map tree that are to be added, the step (E5) further including causing said network configuration data control means to perform the steps of:

extracting the identifier for the appropriate entry from

the information for the entry designated as Add under the temporary map tree and collected through said temporary map tree access means;

10        translating the extracted identifier into an identifier for a corresponding entry designated as Add under the current map tree;

         generating a parameter that specifies that the entry is to be added;

15        modifying, through said current map tree access means, the entry under the current map tree by using the translated identifier as a parameter; and

         repeating the preceding steps until there are no more entries that are to be added.

33. The computer program as defined in Claim 25, wherein said network configuration information management apparatus further includes a network configuration data store section for storing the directory tree information temporarily, and wherein the  
5        computer program further includes a step of causing said network configuration data control means to perform the steps of:

         retrieving, through said current map tree access means, information for a component as specified by the entry under the current map entry and containing the current network

10        configuration information;

         storing the retrieved information in said network configuration data store section temporarily;

searching for information for appropriate temporary map entries that is applicable to any particular time earlier than  
15 a time specified by said external application;

if it is determined that the number of temporary map entries collected is equal to zero, which means that the information under the current map entry that has been obtained may be returned to the external application, returning that  
20 information to said external application;

if it is determined that the number of temporary map entries collected is equal to one or more, collecting the information for each of the entries under the temporary map entry as specified by said external application and obtained through  
25 said temporary map tree access means;

merging the collected entry information under the temporary map entry together with the current map tree previously stored in said network configuration;

merging all of the temporary map entries collected to  
30 update the information under the current map entries stored in the network configuration data store section; and

returning the updated information to said external application.

34. The computer program as defined in Claim 25, wherein

said directory server further includes a log map tree for storing log information for components that occurred in the past; and

5           said network configuration data management apparatus  
further includes a log map tree access means through which it  
has access to said log map tree, and wherein

          in response to the request for the network configuration  
information that is applicable to any particular time in the past,  
10       said network configuration data control means obtains the  
information in the current map tree stored in said directory  
server and the information in said log map tree through said  
current map tree access means and said log map tree access means,  
respectively, and obtains the network configuration information  
15       as requested by merging the information in said map tree together  
with the information in said log map tree that has been setup  
up to said particular past time.

35. The computer program as defined in Claim 25, wherein if there  
are one or more entries under the temporary map tree that are  
to be deleted at the time when the entries under the current map  
entry are being deleted, the computer program further includes  
5       a step of causing said network configuration data control means  
to perform the steps of:

          extracting an identifier for an appropriate entry from the  
information for the entry designated as Delete under the  
temporary map tree and collected through said temporary map tree  
10       access means;

          translating the extracted identifier into an identifier  
for the corresponding entry designated as Delete under the

current map tree;

generating an entry designated as Add under the log map  
15 through said log map tree access means;

deleting the entry under the current map entry through  
said current map tree access means by using the translated  
identifier as a parameter; and

repeating the preceding steps until there are no more  
20 entries that are to be deleted.

36. The computer program as defined in Claim 25, wherein if there  
are one or more entries under the temporary map tree that are  
to be modified at the time when the entries under the current  
map tree are being modified, the computer program further  
5 includes the step of causing said network configuration data  
control means to perform the steps of:

extracting the identifier for the appropriate entry from  
the information for the entry designated as Modify under the  
temporary map tree and collected through said temporary map tree  
10 access means;

translating the extracted identifier into an identifier  
for the corresponding entry designated as Modify under the  
current map tree;

generating a parameter that specifies that the entry is  
15 to be modified;

generating an entry designated as Modify under the log map  
through said log map tree access means;

modifying the entry under the current map entry through  
said current map tree access means by using the translated  
20 identifier as a parameter; and

repeating the preceding steps until there are no more  
entries that are to be modified.

37. The computer program as defined in Claim 25, wherein if there  
are one or more entries under the temporary map tree that are  
to be added at the time when the entries under the current map  
tree are being added, the program code further includes a step  
5 of causing said network configuration data control means to  
perform the steps of:

extracting an identifier for an appropriate entry from the  
information for the entry designated as Add under the temporary  
map tree and collected through said temporary map tree access  
10 means;

translating the extracted identifier into an identifier  
for the corresponding entry designated as Add under the current  
map tree;

generating a parameter that specifies that the entry is  
15 to be added;

generating an entry designated as Delete under the log map  
through said log map tree access means;

adding the entry under the current map tree through said  
current map tree access means by using the translated identifier  
20 as a parameter; and

repeating the preceding steps until there are no more entries that are to be added.

38. The computer program as defined in Claim 25, further including a step of causing said network configuration data control means to perform the steps of:

5 retrieving the information or attribute value for the entry designated as Add or Modify from the corresponding entry in said current map tree through said current map tree access means;

10 extracting an identifier for an appropriate entry from the retrieved information, and translating the extracted identifier into a corresponding identifier under the log map tree;

checking the value for the type of operation;

if it is determined that the type of operation is "delete", setting a parameter for the entry designated as Add under the log map tree to specify "add" as the type of operation;

15 if it is determined that the type of operation is "modify", setting the type of operation for the entry being generated under the log map tree to the value "modify";

20 generating a parameter for the entry being generated under the log map tree, based on an attribute value collected from the entry under the current map tree; and

generating an entry in said log map tree within said directory server through said log map tree access means.

39. The computer program as defined in Claim 25, further

including a step of causing said network configuration data control means to perform the steps of:

5 extracting an identifier for an appropriate entry from the information obtained from the entry designated as Add under the temporary map tree;

translating the extracted identifier into a corresponding identifier for use in generating an entry designated as Delete under the log map tree;

10 setting the parameter for the entry being generated under the log map tree to specify "delete" as the type of operation; and

generating an entry designated as Delete under said log map entry through said log map tree access means.

40. A network configuration control management apparatus including a store section for storing and managing a current map tree that contains the current network configuration information organized into a hierarchical structure and a  
5 temporary map tree that contains the differential information for network components for which configuration changes are expected to occur at any time in the future, and means for referencing the store section and generating a future network configuration information that is applicable to any particular  
10 time later than the current time, based upon the information in said current map tree and the information in said temporary map tree.

